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(54) Antistatic coating for brush elements.

(57) Brushlike materials comprising fibers embedded in or adhesively secured to a carrier layer are used for treating or finishing surfaces or as support means on transporting surfaces. It has been found that the application of a liquid coating layer of an antistatic composition comprising a fluorinated anionic surfactant and a nonionic antistatic agent improves the performance of the brushlike materials.

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ANTISTATIC COATING FOR BRUSH ELEMENTS

BACKGROUND OF THE INVENTION1. Field of the Invention

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The present invention relates to brushlike materials that can be used for the treatment or finishing of surfaces, or for the conveying of other materials along a surface. The present invention further relates to the use of coating compositions to improve the performance of the brushlike materials.

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2. Background of the Art

Brushlike materials have many different utilities in industry. They can be used as finishing tools to modify surfaces or to apply coating compositions; they can be used as cushioning layers to receive materials; they can act as vibratory transport surfaces on conveyors, as well as providing other functions. They can be used in the form of mats, belts, wheels, discs, rolls, and cylinders. Brushes used for most of these purposes tend to provide a surface of filaments essentially perpendicular to their support layer. These filaments may be anchored by embedment in the composition of the carrier layer, by an adhesive on the carrier surface, and/or by mechanical attachment to the carrier surface as by a staple or loop. Where the brushes are used as vibratory conveyors, the filaments are set onto the carrier layer at an angle, most or all of the filaments tilting at about the same angle away from the perpendicular, usually 5-40° away from the perpendicular.

25 SUMMARY OF THE INVENTION

It has been found in the practice of the present invention that the application of a non-volatile, non-integral, electrically conductive organic coating onto the surface of the fibers, bristles or filaments of an industrial brush material can improve its overall performance.

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DETAILED DESCRIPTION OF THE INVENTION

The present invention may be used on any brush material which generally comprises a base with extending bristles or filaments secured to the base. The bristles or filaments may be secured by a wide range of methods or constructions including adhesive securement, tufting into the base, stapling folded over filaments or bristles, and channel crimping of filaments. The preferred construction is an adhesively secured industrial brush construction. An industrial brush construction consists of a base layer, a binder layer and the bristles. The base and the binder may be the same layer and the same material. The bristles are preferably individually and uniformly embedded in the binder such that they project upward and are generally parallel to one another, but they may be formed by bending single filaments and securing the filament at the bend into the adhesive layer. The base layer and the binder layer can be the same material or different material and in general these layers are polymeric materials. For example, the base layer can be a flexible resilient polymeric open cell foam or solid film base, a polyester material, polyurethane, or a nylon material. In addition, a fabric, for example made of cotton, nylon, metal, graphite or polyester can be embedded into these polymeric materials. The binder layer is usually a semi-rigid polymeric material such as a polyurethane, polyester, epoxy or nylon. In the case where the base and the binder layer are the same, it is preferable to use a polyurethane material. In general the thickness of the base and binder layers can range between 0.5 to 20 millimeters or 1 to 10 millimeters, preferably 2 to 5 millimeters. The larger the diameter of the bristles, obviously the thicker the binder layer is.

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The fibers can be selected from many useful types of fibers including the group consisting of: nylon, polypropylene, polyester, polyethylene, metal oxides, inorganic oxides, composition, and metallic fibers. In some cases the fibers can be hollow, which is well known in the brush art. In addition the polymeric fibers may contain abrasive particles such as those well known in the art like silicon carbide and aluminum oxide. The particle size of these abrasive particles will vary depending upon the application, but in general they

will range from 10 to 600 micrometers, preferably 15 to 120 micrometers. If the fiber contains the abrasive particles, the brush material will typically produce a matte type finish on the workpiece. If the fiber does not contain abrasive particles, a glossy type finish will typically be produced on the workpiece. The diameter of the fibers can range from 0.01 to 5 millimeters, preferably 0.2 to 2.0 millimeter. The length of the fiber (above the base surface), or trim length, can range from 2 to 260 millimeters, preferably 8 to 205 millimeters.

In some applications the fibers will be nearly perpendicular to the binder layer, in other applications such as conveyor systems, the fibers will be placed at a specified angle or a specified tilt.

During the manufacture of the industrial brush materials, the binder layer is extruded or otherwise coated onto the base layer. If the base and binder are the same, they can be extruded together. After or during the extrusion process, the fibers are inserted, pressed, or adhered into or onto the binder layer. Next the binder is cured and solidified to form the completed article.

The industrial brush material can be used in a wide variety of abrading and finishing applications. The primary applications for the antistatic coating on the industrial brush fiber material is conveying or moving, cleaning and polishing. It has also been found that the reduction in static charge results in a safer work environment by diminishing the potential for static sparks. In these applications the material exhibits an increased use life, on the order of magnitude of 6 months to over a year. In general, in wood applications or conveying applications the static electricity build-up can result in serious problems for the customer. The antistatic coating has been more successful in the above mentioned applications, than in abrading applications where the bristles ordinarily wear relatively fast. But some improvement is still shown in these environments.

The conveying or moving type applications is best described as placing the industrial brush material in segments in a horizontal bed. The preferred type of construction for this type of application is a polypropylene fiber with a twenty degree tilt. In general static electricity is generated by the workpiece traversing over the bristles. If the industrial brush material is employed for conveyors for electronic parts or light bulbs, the static electricity can seriously damage these parts to the point where the piece is worthless and has to be scrapped.

The second application is cleaning, which entails defuzzing and removing dust from wood workpieces, and cleaning dirt and oil off of metal, wood or plastic workpieces. In these types of applications, the cylinder brushes consist of bristles made from nylon, polypropylene or nylon with abrasive particles embedded therein. The static electricity is generated by the workpieces coming in contact with the bristles. If enough static electricity is generated, a spark could ignite the wood dust and create a serious fire potential. Also in wood applications, the static electricity causes dust to adhere to the bristles, which in turn causes the entire brush to become clogged with wood dust. In metal cleaning, the static electricity causes the dirt and metal shavings to adhere to the metal workpiece rather than being removed from the workpiece by the brush.

The third major application is polishing, in which the brush material is employed to impart a fine finish on metal parts and in some cases can remove light metal oxide build-up. This is typically a low pressure application, pressure less than 34.5 Newton/square centimeter is generated at the interface. The brush material is typically in the form of a cylinder brush. The preferred industrial brush product construction for this type of application consists of nylon or polypropylene fibers. The static electricity is generated by the interaction of the bristles with the workpiece, usually a metal workpiece. Like above, the static electricity results in the metal shavings remaining on the workpiece rather than being removed by the brush.

The conductive coating composition of the present invention has been referred to as "nonvolatile". In the practice of the present invention this means that, after evaporation of any solvents, less than 2 percent by weight per week of the coating composition will evaporate off the surface of an article at 25° C and 40 percent relative humidity. Preferably less than 1 percent by weight per week would evaporate and, more preferably, less than 0.1 percent by weight per week would evaporate at those temperatures and conditions.

The greater the percentage of surfaces of the fiber that are coated with the organic, conductive coating compositions of the present invention, the greater the general reduction in electrostatic charging. This does not necessarily mean that greater amounts of the coating composition better reduce the electrostatic charging, but rather that it is important to insure the coating of as much surface areas as possible on the brush. The coating composition should generally be applied so as to provide a dry (without solvent) coating weight of between 0.5 (0.08 micrograms per square centimeter) and 250 micrograms per square inch (40 micrograms per square centimeter) as an average coating weight. Because the coating composition will not necessarily spread uniformly over the coated surface, or because of surface structure variations (such as embossed non-glare surface), it is the average coating weight that must be considered in this range. If less than this amount of material is applied, insufficient antistatic protection will be provided. If greater than this amount is applied, no further antistatic protection is obtained, and an undesirable, highly greasy appearance

will be provided to the coated article. Preferably a coating weight of 1-100 micrograms per square inch (0.16 to 16 micrograms per square centimeter) is used or more preferably 1-50 micrograms per square inch (0.16 to 8 micrograms per square centimeter). In the most preferred practice of the invention, 5-30 micrograms per square inch of the coating composition is used.

5 The organic coating composition useful in the practice of the present invention may be any nonvolatile, organic, electrically conductive composition. It is highly preferred that the coating is nonintegral or liquid as this provides the greatest static reduction. By "nonintegral" it is meant that the composition does not form a self-supporting solid film when air dried, as it would be when present on the surface of the brush. The term nonintegral therefore excludes the provision of a solid, thermoplastic or nonliquid conductive coating
10 composition to the surface of the brush. Useful conductive coating compositions include the many antistatic agents and systems already known in the art including long chain alkyl quaternary amines, long chain alkyl quaternary phosphines, fluorinated antistatic materials, low molecular weight polymers or oligomers having pendant antistatic ionic groups such as quaternary amine groups, and other ionic, organic material known for antistatic purposes in the art. The preferred material according to the practice of the present invention
15 for use as an antistatic coating composition is the composition of U.S. Pat. No. 4,313,978. This particular composition provides extremely long lasting and high efficiency antistatic protection. That antistatic composition comprises a fluorinated anionic surfactant which is an amine salt of an acid containing a fluorinated organic radical (as defined herein) and an antistatic agent which is an ionic salt of an amine. It has been found that the combination of the fluorinated surfactant and antistatic agent can provide a
20 reduction in static charging at very low application amounts.

The surfactants used in that preferred composition of the present invention are anionic fluorocarbon surfactants which are the amine salts of acids containing a fluorinated organic radical. The preferred surfactants may generally be depicted by the formula:



25 in which

R_f represent a fluorinated organic radical (as defined herein),

A represents a bond or a divalent linking group,

X^- represents an acid anion, and

Z^+ represents a quaternary ammonium cation.

30 The fluorinated organic radical R_f is defined as a radical which is saturated, aliphatic radical having from 2 to 20 and preferably at least 3 carbon atoms, the skeletal chain of which may be straight, branched or, if sufficiently large, cycloaliphatic. The skeletal chain may be interrupted by divalent oxygen or trivalent nitrogen atoms bonded only to carbon atoms provided the radical does not contain more than one heteroatom, i.e., nitrogen or oxygen, for every two carbon atoms in the skeletal chain the radical being fully
35 fluorinated with the exception that it may contain hydrogen or chlorine atoms as substituents provided that not more than one atom of either is present in the radical for each carbon atom. Preferably, the fluoroaliphatic radical is a perfluoroalkyl radical having a skeletal chain that is straight or branched.

The fluorinated organic radical is linked to the acid anion either by a direct bond or through the divalent linkage A. Preferably the chain of the linking group A is composed of carbon atoms although heteroatoms,
40 e.g., nitrogen or oxygen, may be present provided they do not interfere with the ionic nature of the surfactant. Preferred linking groups are alkylene groups.

Particularly suitable acid anions X^- include carboxylic acid and sulfonic acid groups.

Examples of suitable fluorinated organic radical containing anions R_f-A-X^- include 5 to 18 carbon atom perfluorinated alkyls such as perfluoropentyl sulfonate and perfluoro-octylcarboxylate.

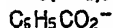
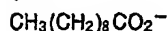
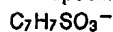
45 The quaternary ammonium groups Z^+ are derived from the corresponding amine. Suitable amines include aliphatic amines and aliphatic cyclic amines, which may optionally be substituted with substituents which will not affect the ionic nature of the surfactant. Preferably the amines contain 2 to 12 carbon atoms. Suitable amines include piperidine, dimethylaminoethanol, morpholine, triethanolamine and triethylamine.

50 Other suitable surfactants include those containing 2 or more acid anions and quaternary ammonium cations in which the acid anions are bonded directly to the fluorinated organic radical or via one or more linking groups. Preferably the fluorinated organic radical is pendant although it may be present within the molecule as in the case of the amine salts of $(C_2F_4COOH)_2$ and $(C_2F_4SO_3H)_2$. Anionic surfactants containing two or more fluorinated organic radicals may also be used.

55 The antistatic agent used in the preferred compositions is an ionic salt of an amine. The compounds have the property that they induce conductivity to the surface upon which they are applied. Suitable amines include those from which the quaternary ammonium groups Z. Are derived. The anionic portion of the antistatic agent may be chosen from a wide variety of anions including halide, sulfate, aryl sulfonate, aliphatic sulfonate, aryl carboxylate and aliphatic carboxylate. The anions may contain further substituents

providing they do not affect the antistatic properties of the compound, for example, the presence of nitrogen atoms and highly fluorinated radicals is undesirable in the anion.

Specific examples of anions include:



The fluorinated surfactant and antistatic agent may be derived from the same or different amines.

The compositions are preferably applied from a single solution. Suitable solvents include lower alcohols, e.g., ethanol and isopropanol, which may be diluted with a low boiling fluorocarbon. Preferably the solvent is chosen such that the fluorinated surfactant and antistatic agent have substantially the same solubility so that the dried coating contains the same ratio of constituents as in the applied solution. If there is a substantial difference in the solubilities, nonuniform coatings may result.

The ratio of fluorinated surfactant to antistatic agent in a composition depends upon the intended use.

The concentration of the solutions vary according to their intended use. Preferably the anion molar percent of the fluorinated organic radical is between 1 and 50%, preferably 1.8 and 47.9%, and most preferably between 15 and 40 percent of the mixture of the two ingredients. The present invention has been found to be independent of the specific antistatic composition used, although some, of course, perform better than others because of their physical properties.

The solutions can be applied to the brush material by any conventional techniques such as roll coating, spraying, brushing and immersing. After the solution is applied it is dried to remove the volatiles either at room temperature or at elevated temperatures.

The following examples will illustrate the various embodiments.

Control Example

The control example was an untreated BRUSHLONTM material, polypropylene fibers, with a twenty degree tilt, part number 721B commercially available from the 3M Company, St. Paul, MN.

Example 1

The following formulation was prepared 800 grams of FREON TF solvent from DuPont, 150 grams of isopropyl alcohol, 50 grams of heptane, 0.44 grams of deionized water, 0.026 grams of piperidinium toluene sulfonate, 0.104 grams of piperidinium perfluoro-octyl sulfonate and 0.1684 grams of STATICIDETM commercially available from American Chemical Laboratories. STATICIDETM is a humectant and consists of ethyl benzyl ammonium chloride mixture with N-alkyl C12 to C16.

Example 2

The following formulation was prepared 800 grams of FREONTM TF solvent from DuPont, 200 grams of ethyl alcohol, 0.2 grams of CARBOWAXTM PEG 400 purchased from Union Carbide Corp., 0.32 grams of piperidinium toluene sulfonate and 1.28 grams of piperidinium perfluoro-octyl sulfonate. The CARBOWAXTM PEG 400 is a humectant and consist essentially of polyethylene glycol.

Example 3

The following formulation was prepared 1000 grams of isopropyl alcohol, 1.6 grams of piperidinium perfluoro-octyl sulfonate, and 0.4 grams of piperidinium toluene sulfonate.

Example 4

The following formulation was prepared 1000 grams of methyl alcohol, 0.8 grams of piperidinium

toluene sulfonate and 3.2 grams of piperidinium perfluoro-octyl sulfonate and 4 grams of CARBOWAX™ PEG 400 purchased from Union Carbide Corp. The CARBOWAX™ PEG 400 is a humectant and consist essentially of polyethylene glycol.

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Example 5

The following formulation was prepared 600 grams of ethyl alcohol, 400 grams of deionized water, 0.8 grams of piperidinium toluene sulfonate and 1.6 grams of piperidinium perfluoro-octyl sulfonate and 0.32
10 grams of CARBOWAX™ PEG 400 purchased from Union Carbide. The CARBOWAX™ PEG 400 is a humectant and consist essentially of polyethylene glycol.

In the previous examples, the piperidinium salts were added first to the alcohol portion of the solution, then the salts were dissolved into the alcohol and finally the other components were added. In the cases where the deionized water was used, it was added last to the formulation.

15 Next, three 5 cm by 10 cm BRUSHLON™ samples per example were cut and the entire BRUSHLON™ a sample was immersed into the various solutions. The excess solution was gently shaken off then placed to dry overnight with the fibers up.

The residual charge for each example was measured using a Monroe Electrostatic Fieldmeter placed 2.54 cm from the sample. The residual charge is a measure of how conductive a material is prior to any
20 static electricity being generated. Then a fresh carpet segment for each test sample (100% nylon, 1.25 cm loft, multistrand, 12.5 cm by 28 cm in area) was rubbed 10 times against each BRUSHLON™ sample to generate a static charge. Immediately, another reading, the electrostatic charge, was taken in the same manner as the residual charge was measured for each sample. The electrostatic charge measures how resistant the BRUSHLON™ material was to static electricity. The results can be found in Table 1, each
25 reading represents an average of three samples.

Table 1

Example	Residual Charge	Electrostatic Charge
	(volts)	(volts)
Control	5	2710
1	3.5	265
2	10	130
3	6.5	255
4	1.5	70
5	5	40

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It can be concluded from the above data that the formulations of the Examples significantly reduce the amount of static charge build-up on the BRUSHLON™ material.

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Example 6

A BRUSHLON™ material (a polypropylene fiber, 20 degree tilt, part number 721B available from 3M Company, St. Paul, MN) had an antistatic coating applied that consisted of by weight 94% ethyl alcohol, 0.4% piperidinium toluene sulfonate, 1.6% piperidinium perfluoro-octyl sulfonate, 2% CARBOWAX™ PEG
50 400 purchased from Union carbide corp. and 2% STATICIDE™ purchased from American Chemical Laboratories.

The treated BRUSHLON™ material was employed by an independent third party under a confidential disclosure agreement as a conveyor means for radio circuit boards for four months and 10 days. If there is
55 static electricity generated as these boards move across the BRUSHLON™ material, the static electricity seriously damages the boards, to the point that some of them are unusable. On average about 1000 boards/week are transported across this conveyor system and on average two percent of the boards would be lost due to the static electricity problem.

Prior to this invention, the third party utilized 3M's BRUSHLONTM material as a conveyor means, but sprayed the bristles on average anywhere from once a day to once a week with STATICIDETM to prevent static build-up. The third party has stated that the STATICIDETM coating had never lasted more than one week. The present invention was employed for four months and ten days without any damage to any of the circuit boards.

Example 7

In this example, various BRUSHLONTM wheels (available from 3M Company) having a 21 cm inner diameter and was approximately 31 cm in width were utilized. All of the wheels contained nylon fibers that were approximately 3.18 cm in length.

Wheel A had 0.041 cm diameter fibers and contained the non volatile organic treatment of this invention. The non volatile organic treatment contained by weight 90% deionized water, 10 ethyl alcohol, 0.2% polyethylene glycol and 0.2% Harlow Salts. The Harlow Salts consisted of 80% by weight piperidinium perfluoro-octyl sulfonate and 20% by weight piperidinium toluene sulfonate. The organic treatment was mixed by first fully dispersing the Harlow salts into the ethyl alcohol, then the polyethylene glycol was added, followed by the deionized water. The organic treatment was continuously mixed throughout the preparation. The organic treatment was then applied to the brush by spraying and the excess organic treatment drained off of the brush. The brush then sat for a few days to allow the treatment to dry.

Wheel B had 0.041 cm diameter fibers and contained the STATICIDETM treatment. The STATICIDETM treatment (American Chemical Laboratories) consisted of by weight 0.13% n-alkyl (60% C14, 30% C16, 5% C12 and 5% C16) dimethyl benzyl ammonium chlorides, 0.13% n-alkyl (68% C12, 32% C14) dimethyl ethyl benzyl ammonium chlorides and 99.84% inert ingredients. The STATICIDETM treatment was applied to the brush in the same manner as Wheel A.

Wheel C had 0.051 cm diameter fibers and contained no antistatic treatment.

The above discussed three brushes were tested according to the following procedure. Each brush was installed on a Timesavers (Minneapolis, MN) conveyorized brush machine. The brush rotated at approximately 900 revolutions per minute. The conveyor belt contained a particle board workpiece which was abraded by the brush. The conveyor belt operated at 9.2 meters/minute. The interference between the ends of the bristles and the workpiece was 0.11 cm. After thirty minutes, in which the workpiece was in contact with the brush wheel, the workpiece was removed. The purpose of this thirty minutes was to generate heat and static electricity which is typically seen in industrial brush applications. Next, the workpiece was passed underneath the brush three more times, each time the electrical charge on the brush was measured. The measurement was taken approximately 2.54 cm from the bristles using a Model 255 Digital Stat-Arc electrostatic field meter while the brush rotated. Then the workpiece was passed underneath the brush for a fourth time and the electrical charge on the workpiece was measured. The results can be found in Tables 1 and 2. The values are based upon the highest readings. The test was stopped once the charge on the brush exceeded 9000 volts.

Table 1

Electrostatic Charge on the Brush Wheels			
Time	Wheel A	Wheel B	Wheel C
minutes	volts	volts	volts
30	720	4100	13,400
60	380	9960	
90	790		
120	1170		
150	1070		
180	1780		
210	2110		

Table 2

Time	Electrostatic Charge on the Workpiece		
	Workpiece From Wheel A	Workpiece From Wheel B	Workpiece From Wheel C
	minutes	volts	volts
30	7800	4800	880
60	5820	4600	
90	8680		
120	6430		
150	8230		
180	7840		
210	5960		

It was concluded from the above data that the brush of the invention (Wheel A) had significantly less static charge than the prior art brushes. It appeared that the Wheel B (STATICIDETM treatment) wore off or evaporated rather quickly and the voltage reading approached Wheel C. It was also noted that as the static charge corresponding to the workpiece decreased, the static charge corresponding to the brush increased. It is known in the art that the static charge corresponding to the brush wheel is more significant than the static charge corresponding to the workpiece.

Example 8

Various BRUSHLONTM segments (available from 3M Company), 5.1 cm by 12.7 cm and having 0.030 cm diameter by 2.2 cm length polypropylene fibers with a 20 degree tilt to them were utilized in this example. Segment A contained the organic treatment of the invention and this treatment was applied in the same manner as Wheel A (Example 7). treatment was applied in the same manner as Wheel B (Example &). Segment C did not contain any treatment.

The segments were then tested according to the following procedure. A nylon carpet piece was held stationary and the segment was pulled across the carpet by hand to generate static charge. Then, after a number of strokes which were listed in Table 3, the static charge in volts were measured. The static charge values are an average of five different BRUSHLONTM samples for each segment. The segment was placed in a vertical slot and the field and the field meter was placed 90 degrees from the brush segment. The field meter was the same as the one described above. A new piece of carpet was used every 50 strokes. Additional for the 50 strokes, the same piece of carpet was used for segments A through C, although for each brush segment a different area of the carpet was rubbed.

Table 3

5	Electrostatic Charge on the Carpet			
	Strokes	Voltage of Segment A	Voltage of Segment B	Voltage of Segment C
	0	50	50	3500
	50	50	50	4500
10	100	225	175	3700
	150	300	225	2750
	200	275	300	2700
	250	250	300	
	300	275	250	
15	350	300	350	
	400	250	225	
	450	800	750	
	500	300	225	
	550	800	750	
20	600	1050	950	
	650	1450	900	
	700	1250	750	

Claims

1. A brush element comprising a base and bristles, said bristles being firmly secured to said base, said
30 bristles having a diameter of from 0.01 to 5 mm and having a coating of a non-volatile, non-self-supporting electrically conductive organic on the surface of the bristles.
2. The brush element of claim 1 wherein said base comprising a distinct carrier layer and an adhesive layer.
3. The brush element of claim 1 wherein said bristles are approximately perpendicular to said base.
4. The brush element of claim 2 wherein said bristles are approximately perpendicular to said base.
- 35 5. The brush element of claim 1 wherein said bristles are at an angle away from perpendicular to said base of from 5 to 40°.
6. The brush element of claim 2 wherein said bristles are at an angle away from perpendicular to said base of from 5 to 40°.
7. The brush of claim 1 wherein said composition is present in an amount between 0.5 and 250 micrograms
40 per square inch and comprises a material which is an antistatic composition selected from the group consisting of (a) quaternary amines, (b) quaternary phosphines, and (c) perfluorinated ionic compounds.
8. The brush of claim 2 wherein said composition is present in an amount between 0.5 and 250 micrograms per square inch and comprises a material which is an antistatic composition selected from the group consisting of (a) quaternary amines, (b) quaternary phosphines, and (c) perfluorinated ionic compounds.
- 45 9. The brush of claim 3 wherein said composition is present in an amount between 0.5 and 250 micrograms per square inch and comprises a material which is an antistatic composition selected from the group consisting of (a) quaternary amines, (b) quaternary phosphines, and (c) perfluorinated ionic compounds.
10. The brush of claim 4 wherein said composition is present in an amount between 0.5 and 250
50 micrograms per square inch and comprises a material which is an antistatic composition selected from the group consisting of (a) quaternary amines, (b) quaternary phosphines, and (c) perfluorinated ionic compounds.



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 90308518.1
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	"Vibrating conveyor delivers parts to robot" (reprinted form design news, August 17, 1981, 1981 CAHNERS PUBLISHING COMP. BRIAN J. HOGAN) * Totality *	1-6	D 06 M 13/46 D 06 M 13/285 D 04 H 11/00 A 46 B 15/00 A 46 B 7/04 A 46 B 9/02 A 46 D 1/00
D,A	BRUSHLON PRODUCTS (Industrial Abrasives Division/3M; 223-6NW-013M Center St. Paul, MN 55144-1000) * Belts, wheels, discs, rolls & cylinder brushes *	1-6	
A	DE - A - 1 560 699 (BURKART-SCHIER CHEMICAL CO.) * Totality *	1-6	
A	DE - A - 1 956 342 (EXAKTE SCHAUMGUMMI- UND SCHAUMSTOFFFABRIK GMBH) * Fig. 1; claim 1 *	1-4	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	DE - A - 2 126 586 (ARTOS DR. ING. MEIER-WINDHORST KG) * Claim 4; page 2, lines 3-8 *	1-4	D 06 M 13/00 D 04 H 11/00 A 46 B 1/00- A 46 B 15/00 A 46 D 1/00
D,A	US - A - 4 313 978 (STEVENS) * Claims 1-3 *	1,7-10	
A	US - B - 265 862 (DONALDSON) * Abstract *	1,7-10	
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 20-11-1990	Examiner PIRKER
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			